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14. ABSTRACT: In first year of the award (2015), 5 meritorious students were selected under HBCU Summer Undergraduate Training Program in Prostate Cancer by USU-CPDR and UDC selection committee to provide motivating experience in the state-of-the-art CaP research. The main objectives are: (a) Recruit and motivate highly qualified undergraduate trainees from UDC, (b) expose UDC students to an intellectual environment that promotes state-of-the-art hands-on training and education in CaP research through special lectures by CPDR scientists and guest lectures, (c) motivate summer interns to contribute to CaP research centers at HBCUs, (d) to ensure that the new generation of biomedical scientists are properly trained to continue the fight against CaP Specific Aims: Aim 1. Selection of students and exposure to the state-of-the-art CaP research environment; Aim 2. Assignment of mentors and research project; Aim 3. Progress report preparation and presentation. Results: During the current reporting period, selected 5 students were assigned to the faculty members of USU-CPDR, focusing on specific research projects in basic science and database research. Students were exposed to training in Laboratory safety, performing experiments in basic techniques of cell biology, experimental design, and how to conduct key experiments pertaining to their research projects. Students prepared and presented their research goals and objectives and experimental and progress in biweekly presentations. At the end of the training, each student made PowerPoint presentations of the completed project and conclusions in a seminar and submitted the entire project to the supervisors. Each student was given a certificate of completion of achievement. The students presented their experimental results at the Institutional and National meetings focusing the HBCU training and research. Conclusions: During this period, the students have displayed tremendous of interest in the field of prostate cancer and have gained experience. The results obtained from their experiments will be presented as posters in upcoming HBCU conferences at national level. Overall, this has been extremely rewarding experience for the students, mentors and for collaborating Institutions.					
15. SUBJECT TERMS HBCU-Prostate Cancer Training, Center for Prostate Disease Research (CPDR), University of District of Columbia (UDC), DoD-PCRP, Uniformed Services University (USU), Department of Surgery, Walter Reed National Military Medical Center (WRNMMC), Basic Science Research Program (BSRP).					
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INTRODUCTION

The goal of **HBCU Summer Undergraduate Training Program in Prostate Cancer: A Partnership between USU-CPDR and UDC** award was to expose UDC students to the advances in prostate cancer (CaP) research motivate them to pursue research careers in CaP. During the first year of the grant reporting period, the USU-CPDR and UDC team developed and executed a well structured program offering exciting training opportunities to students in a multidisciplinary CaP research environment. The integrated basic science and clinical research programs of the CPDR team led by Shiv Srivastava, PhD and COL (ret) David G. McLeod, MD was credited with leading accomplishments in CaP research, state-of-the-art patient care, education and the training of the next generation of CaP researchers. Well accomplished USU-CPDR faculty members with outstanding credentials in basic or clinical prostate cancer research contributed to this collaborative effort. **The objectives** of this training program were to: (1) recruit and motivate highly qualified undergraduate trainees from UDC; (2) expose UDC students to an intellectual environment that promotes state-of-the-art hands-on training and education in CaP research through special lectures by CPDR scientists and guest lecturers; (3) motivate young researchers, who may contribute to CaP research centers at HBCUs; (4) to ensure that the new generation of biomedical scientists are properly trained to continue the fight against CaP.

Specific Aims (as mentioned in the grant proposal):

- **Select students and expose them to the state-of-the-art CaP research environment.** Meritorious students (4/year; 12 for the 3 year grant period) will be selected and exposed to a structured, well-rounded training program that integrates expertise, tools and motivation to pursue careers in prostate cancer research.
- **Assignment of mentors and research project.** The students will be paired with the mentors and will be assigned a specific short-term research project. Student will conduct experiments in their respective laboratories under the supervision of their mentors. During the 12 weeks period, the students will learn key issues in CaP research and will gain hands on experience in CaP molecular biology experiments.
- **Progress report preparation and presentation.** At the completion of training, the students will prepare a written report and present their research at institutional and national conferences.

This program was led by Dr. Shiv Srivastava, PhD, Principal Investigator/Program Director (USU-CPDR), Dr. Deepak Kumar, PhD, Partnering PI (UDC) and Taduru Sreenath, PhD, Co-Investigator (USU-CPDR) in the management and administration of the award, selection of the students and mentors, pairing the students with the mentors, selection of the realistic and achievable projects, as well as the continued development and enhancement of this collaborative training program.

Each student admitted to the program was assigned to a USU-CPDR faculty member, with a specific research project to yield new data and findings within the allotted time of 12 weeks. Through regular meetings, seminars and personal discussions, the students interacted with other fellow students, faculty members and staff. At the end of the summer experience, all students presented their research progress and findings to USU leadership, CPDR scientific staff and PI at CPDR Rockville location. Each student was awarded with a certificate of completion and achievement. Each student will be preparing the abstract and poster for upcoming local and national conferences.

BODY

Task 1: Selection Process: USU-CPDR summer internship program announcements for 2015 were made at the UDC through advertisements displayed on the bulletin boards of all the departments, campus newspaper, common meeting areas of students around the UDC campus and UDC website (Attachment #1). This advertisement provided details of the opportunity for talented UDC students to take part in a 12-week summer research experience in prostate cancer research for undergraduate students majoring in science, technology, engineering and mathematics (STEM) disciplines. The completed applications consisting of essay of interest, transcripts and letters of recommendation were considered for selection process. Five meritorious students were selected by USU-CPDR and UDC the selection committee composed of the faculty advisors for the summer Undergraduate Training Program, PI and the Co-PI based on their interest in research, transcripts, letters of recommendation.

The following were the successful applicants:

- Ms. Annie Bagga
- Ms. Mulenga Chileshe
- Mr. Quinton Sistare
- Ms. Shahnoza Dusmatova
- Ms. Shanice Cumbee

Task 2: Assignment of Mentors and Projects: Faculty members of USU-CPDR were selected by the PIs to serve as mentors and to set-up goals to carry out a specific research projects based on student's specific research interest. Mentors worked closely with students to identify a realistic and achievable research project to include goals and objectives. The projects assigned to the individual students were well structured and well rounded programs that provide them with knowledge, expert guidance and tools to successfully complete the assignments. Short-term realistic projects within our ongoing Basic and Translational research were designed for students.

Mentors: Highly dedicated scientists from USU/CPDR with over 15-30 years of research experience, widely recognized in the clinical and basic science research in prostate cancer field, were served as mentors. All of these scientists have extensive experience in teaching and training urology residents, postdoctoral fellows and medical and undergraduate students.

Assignment of mentors, research projects to yield the new data:

Student:	Ms. Annie Bagga
Mentor:	Dr. Alagarsamy Srinivasan, Ph.D
Research Project:	Antigen-Antibody Interactions: identification of antibody specific contact regions involved in binding to ERG

Elevated levels of *ERG*, an oncogene, was found in 50-70% of prostate cancer patients. Recently, we developed a highly specific antibody (9FY) to ERG to diagnose ERG positive tumors. One of the therapeutic strategies was to down-regulate the levels of ERG protein to control the prostate cancer in patients. The goal of this project was to identify and modify specific amino

acid residues of antibody fragments to enhance its binding capability towards development of potential therapeutic agent to prostate cancer.

Student: Ms. Mulenga Chileshe
Mentor: Dr. Ahmed Mohamed, MD, Ph.D
Research Project: Evaluation of the synergistic effects of AR and NOTCH inhibitors in ERG positive prostate cancer cells

Androgen regulated TMPRSS2-ERG plays a critical role in prostate cancer initiation and progression. We discovered that ERG regulates NOTCH signaling pathway, which is frequently deregulated in human malignancies. Hence, we reasoned that targeting both AR and Notch signaling by a combination of AR and NOTCH inhibitors to prevent the cell growth and survival of the prostate cancer.

Student: Mr. Quinton Sistare
Mentor: Dr. Shyh-Han Tan, Ph.D
Research Project: Role of ANXA2 in Prostate Cancer Progression

The hypothesis of the project was that the over-expression of Annexin A2 (ANXA2) stimulates cell invasion and migration of CaP cells. The goal was to generate the ANXA2 lentivirus constructs and analyze the prostate cancer cell lines for cell proliferation and migration assays.

Student: Ms. Shahnoza Dusmatova
Mentor: Dr. Jennifer Cullen, PhD, MPH
Research Project: Integrated clinic-pathologic and molecular dynamics of novel form of TMPRSS2-ERG hybrid prostate cancers (CaP)

Although there is lack of classification of hybrid-staining TMPRSS2:ERG prostate cancer tumors, they represent a distinct cancer phenotype with biologically and clinically distinctive behavior. The goal of this project was to characterize hybrid tumor specimens for their morphological and molecular features, and examine their association with CaP progression and outcomes.

Student: Ms. Shanice Cumbee
Mentor: Dr. Jennifer Cullen, PhD, MPH
Research Project: Interrelationship between Race, Body Mass Index, & Gene Expression Levels in Prostate Cancer

The main objective was to explore relationships of Lacto-transferrin (LTF) expression in tumor and normal prostate epithelial cells with progression of prostate cancer (CaP). Correlation of all expression markers -- tumor with tumor, normal with normal -- was of interest, as well as with body mass index and CaP progression. Development of basic SAS software

knowledge was also required, in order to perform statistical analysis of LCM data, including: Spearman rank correlation, Pearson correlation, Chi-square analysis, Students t-testing, and ANOVA testing.

Task 3: Training, Goals and Objectives: The goals and objectives were designed to educate and cultivate interest in the students on the importance of understanding basic and translational aspects of prostate cancer research. Specific achievable goals were set to the successful completion of research questions/projects. Throughout training, main emphasis was given to the principles and practice of methods associated with a specific research question and addressing through a sound hypotheses, research design, methodologies, data collection, analysis, and data interpretations.

During the training period the students were taught basics of cell biology and cancer biology techniques, experimental design, and execution of their research projects. The experiments were performed by the students under the close supervision of mentors or their designees (staff scientist, post-doctoral fellow, and research assistant). Students learnt various aspects of prostate cancer including biology, epidemiology, diagnosis, prognosis and therapy through laboratory meetings, weekly/biweekly seminars and personal discussions with scientists. Students freely interacted with other fellow students, faculty members and staff.

Task 4: Periodical meetings of Faculty advisors to monitor Student's progress: Mentors interacted with students on a daily basis during the entire training program to monitor their understanding of the research and progress. In addition, mentors also formally met with the students once a week to train them in compiling the data, interpretation of the results and the need for additional experiments to achieve goals and objectives of the project. These meetings were mainly focused on specific academic goals of students and guide them in strategizing an individual development plan (IDP). The monthly meetings were conducted to ensure periodic assessments of each student and assist the faculty mentors in determining appropriate interventions in order for the students to accomplish their goals and objectives.

Monitoring students' progress after the training period: Interaction of the PIs, Co-Investigators, faculty members and mentors with the students will be continued after the summer program and their graduation. The students were advised to meet quarterly with the mentors and PIs for counsel and to address any concerns towards their IDPs. The mentors and the PIs will also guide students in selecting the study programs (graduate or professional) and writing research statements and providing recommendation letters. The extended mentoring program was designed to help in two important ways: (1) faculty mentoring for scientific exchanges and career advice, and (2) peer connection and peer mentoring where students will exchange their experiences and ideas with fellow students.

KEY RESEARCH ACCOMPLISHMENTS

All 5 students selected under HBCU Summer Undergraduate Training Program successfully completed their projects assigned to them.

Highlights of their project outline and experimental results were the following:

Annie Bagga

- Paratope residues involved in binding to the epitope were analyzed
- Chimeric constructs were generated using split Venus reporter and antibody fragments
- Site-specific mutagenesis was performed using alanine substitutions to identify the candidate residues involved in the interaction
- Arginine and isoleucine are found to be potentially involved in optimizing antibody binding to the epitope.

Mulenga Chileshe

- Inhibition of AR combined with inhibition of NOTCH signaling resulted in
 - a greater decrease in cell motility and invasion,
 - altered EMT and increased differentiation of cells
 - enhanced drug sensitivity,
 - potential inhibition of tumor development and/or progression

Quinton Sistare

- ANXA2 was cloned into a lentiviral construct
- Viral titer was determined for effective MOI to infect prostate cancer cell lines
- Over expression of low levels of ANXA2 in C4-2B cells increases cell migration
- Higher levels of expression has shown decreased cell migration

Shahnoza Dusmatova

- Observations proposed, patients $\geq 80\%$ ERG positive have striking difference in comparison to both ERG negative and ERG positive cohorts
- Comparison of ERG-hybrid $< 80\%$ to ERG negative and ERG positive groups revealed significantly lower BMI in a hybrid group
- Majority of patients are CA in hybrid group

Ms. Shanice Cumbee

- Expression correlations of c-MYC, HIPPI, PSGR with BMI vs BCR found to be statistically significant
- Expression correlations of c-MYC, HIPPI with Race vs BCR found to be statistically significant
- Expression correlations of ERG1, ERG3, PSGR in African American/Caucasian Men vs BCR found to be statistically significant

REPORTABLE OUTCOMES:

- The program was initiated with the successful applicants meeting with Dr. Shiv Srivastava, Program Director, who provided the students with an overview of the DOD Collaborative Undergraduate HBCU Student Summer Prostate Cancer Training Program, goals and objectives.
- Students specific interests were discussed
- Laboratory safety training was given to the students by Ms. London Toney, Laboratory Manager
- Short-term realistic projects within our ongoing **Basic and Translational research** were designed for students
- Mentors were selected by the PIs based on student's specific research interest
- Mentors worked closely with students to identify a research project to include goals and objectives
- Students presented their research progress to CPDR scientific staff and PI at CPDR Rockville location in biweekly meetings
- Students presented their complete project report and conclusions
- At the completion of training, the students prepared a complete written report to the mentors in a manuscript format

During this period, the students have displayed tremendous of interest in the field of prostate cancer and have gained experience. The results obtained from their experiments will be presented as posters in HBCU conferences at national level.

CONCLUSIONS:

The students selected under HBCU Summer Undergraduate Training Program in Prostate Cancer Research program have successfully completed the projects assigned to them. They participated in daily meetings with the supervisors, received training in carrying-out the experiments, and recorded the data in electronic laboratory notebook on daily basis. Students participated in weekly seminars and made PowerPoint presentations every 2 weeks to show their progress. At the end of the 12 weeks, students made final presentations and submitted the complete report on the project. This has been extremely rewarding experience for the students, mentors and for collaborating Institutions.

During the training period, the students learned the following:

- The important issues in CaP research in high-risk populations with a special focus on AA patients
- Good understanding of the research project and its significance to CaP
- Basic skills in planning and execution of a research project focused on a defined question related to molecular and cell biology of CaP or translational CaP research
- The value of laboratory experiment records and maintain electronic note book
- Preparation of high-quality slide and poster presentations and final written report
- Critical issues related to laboratory safety and laboratory hygiene and
- Dedication, perseverance, and effort it takes to perform research of the highest quality in the laboratory.

In summary, this collaborative training program has cultivated sufficient interest in students to understand the importance of prostate cancer research.

REFERENCES:

None

APPENDICES:

Supporting Data:

Summer Research Opportunity Announcement: Attachment#1

2015 SUMMER UNDERGRADUATE RESEARCH OPPORTUNITY



Summer research opportunity is available at the Department of Defense - Center for Prostate Disease Research (CPDR), Uniformed Services University (USU) of *Health Sciences* on a UDC-CPDR jointly funded program.

The Department of Defense, United States Army Medical Research and Materiel Command (USAMRMC), has awarded a new 3-year Prostate Cancer Research Program (PCRP) Collaborative Undergraduate Historically Black College And University Student Summer Training Program grant to the Uniformed Services University of the Health Sciences' (USU) Center for Prostate Disease Research (CPDR) and the University of the District of Columbia (UDC) collaborative team.

A successful collaborative effort between Dr. Deepak Kumar, from UDC and Dr. Shiv Srivastava, from USU/CPDR continues to provide a great opportunity for UDC students to take part in Prostate Cancer Training Program that is conducted during the summer break. The Program provides a 10-12 weeks summer research experience in prostate cancer research for undergraduates majoring in science, technology, engineering and mathematics (STEM) disciplines. The goal of this program is to prepare a diverse, highly talented, educated, and skilled pool of scientists interested in Prostate Cancer Research. The students will be exposed to cutting edge research methods in prostate cancer and will be mentored throughout their tenure at UDC. Several of past mentees are pursuing graduate and professional schools. More information about CPDR can be found at <http://www.cpdr.org>.

The Program is also recently highlighted by the Department of Defense – CDMRP's Prostate Cancer Research Program. <http://cdmrp.army.mil/pcrp/pbks/pcrppbk2014.pdf> [page 13]

- Four (4-6) students will be selected for summer, 2015 starting on June 1, 2015

Eligibility Requirements

- The applicant must be a junior or senior at UDC when he/she returns to school in Fall 2015.
- Must be studying in STEM disciplines with an interest in Prostate Cancer Research.
- Must have a cumulative GPA of 3.0 or above at the time of application.

Stipend

- The participants to this program will receive a stipend @ \$12/hr, 40h/week for 10-12 weeks.

Application

- Submit a letter of intent along with a short essay (1 page) on how this program will help you in achieving your career goals. The application must be submitted by email. The deadline for application is March 30, 2015. Selected applicants will be notified by April 30, 2015.

Submit your application to

Dr. Deepak Kumar

Co-PI and Director of the UDC-CPDR Summer Research Program

Division of Science and Mathematics

University of the District of Columbia

4200 Connecticut Avenue NW; Washington DC 20008

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